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(54) Abstract Title

Spirit level device

(57) The spirit level 1 comprises three side members 2,3,11 defining sides of a right angled isosceles triangular frame, the first 2 and second 3 side members being of equal length and arranged at 90° to each other, each of the side members 2,3,11 having a planar outer surface 5,7,11' upon which the device can rest. The side surfaces of the first, second and third side members lie in the same plane to allow the spirit level device to rest on a flat surface on the side surfaces. Spirit level tubes 13,14 are provided in the first 2 and second 3 elongate side members. A third spirit level tube 15 is rotatably mounted within the space defined by the first 2, second 3 and third 11 side members, a graduated scale 22 being associated with the third spirit level tube 15.

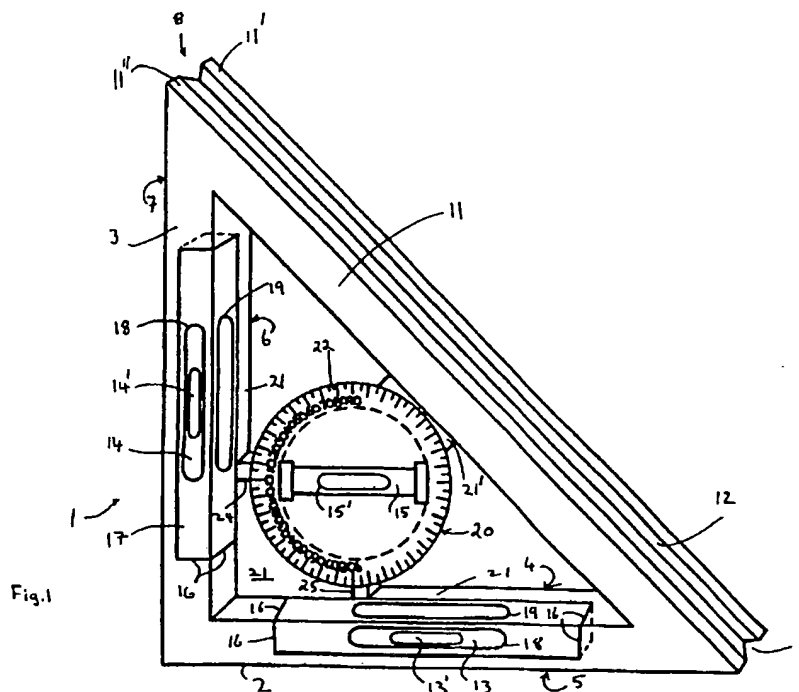


Fig. 1

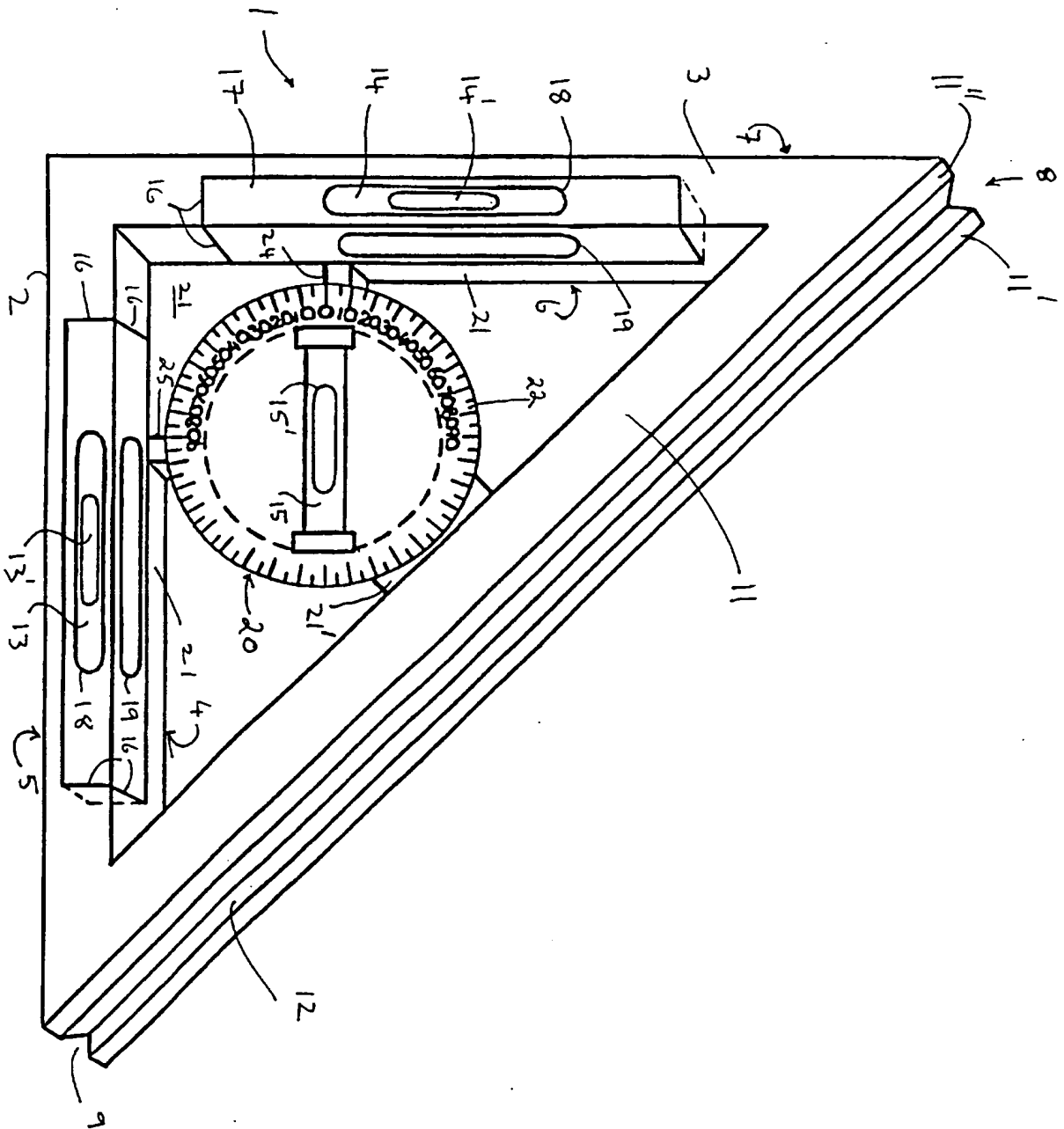


Fig. 2

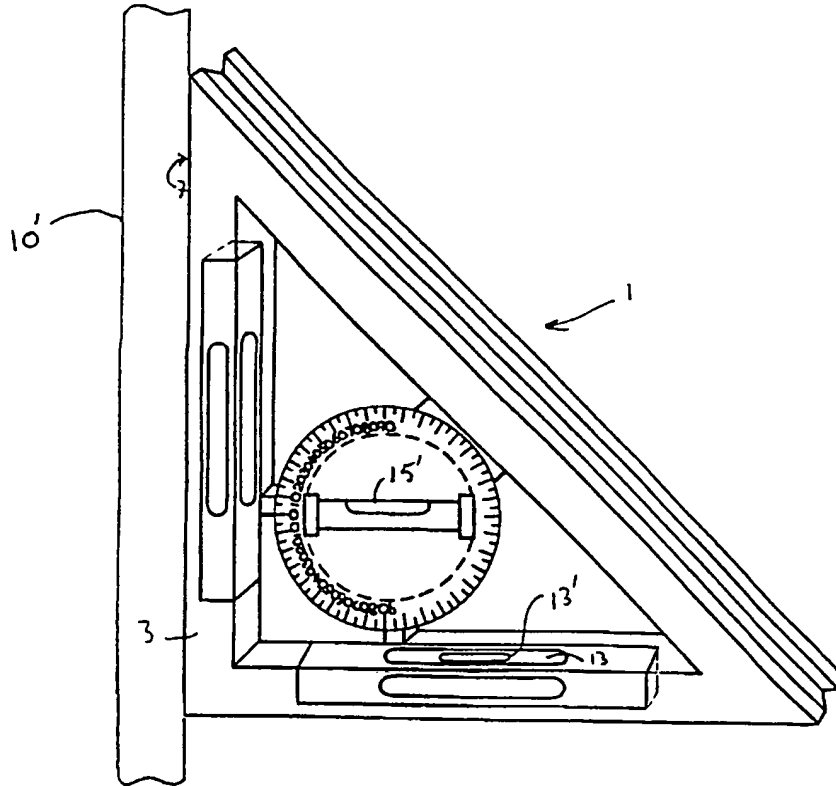
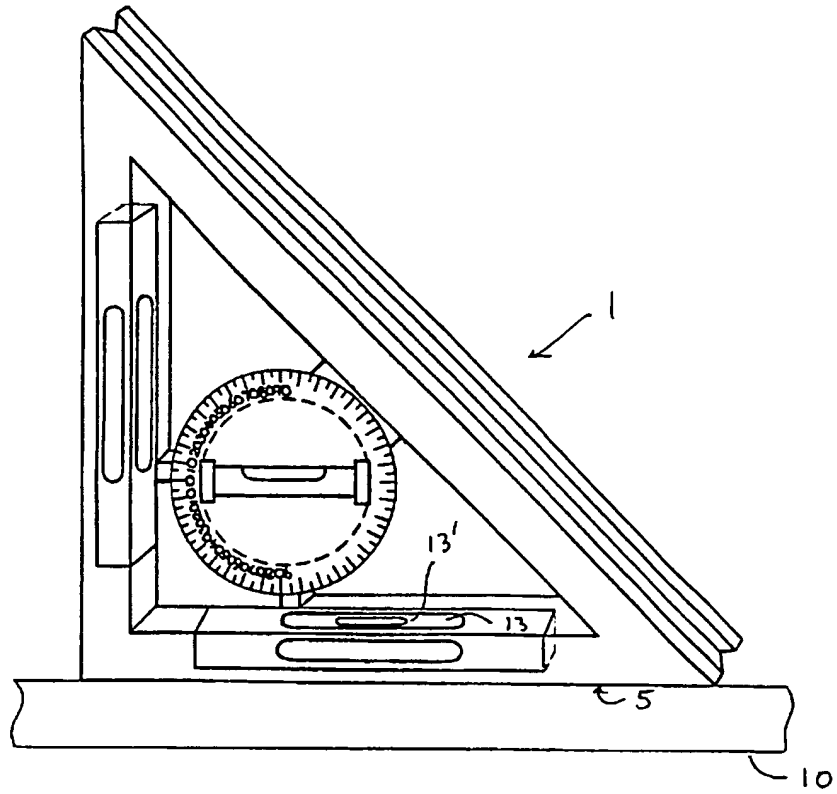


Fig. 3

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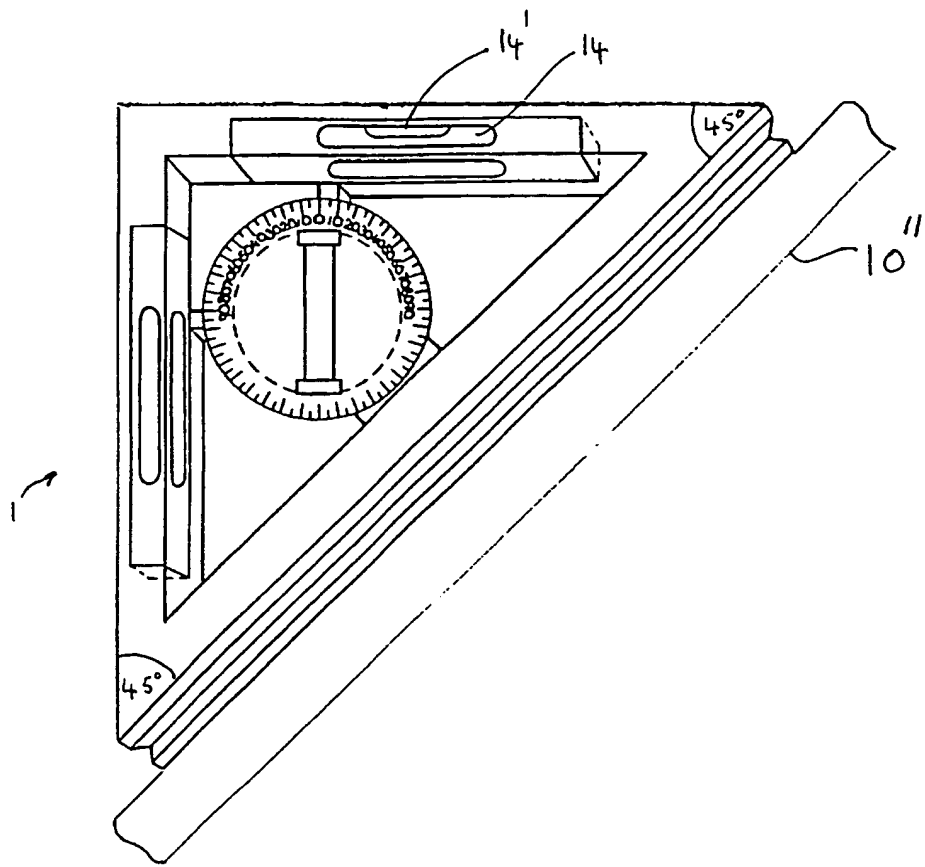


Fig. 4

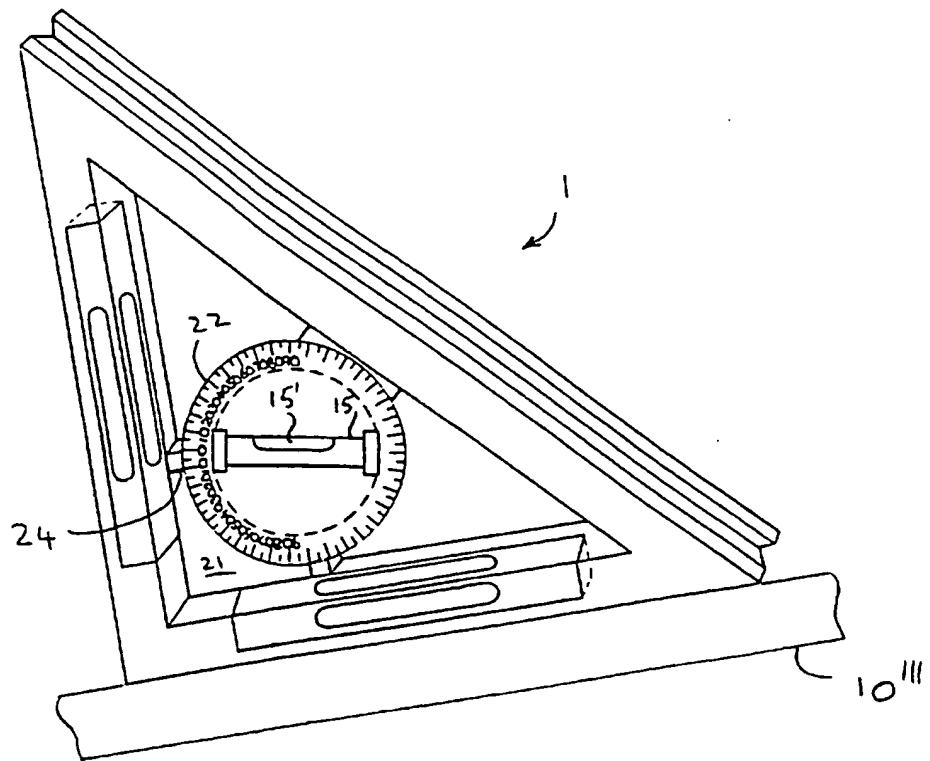
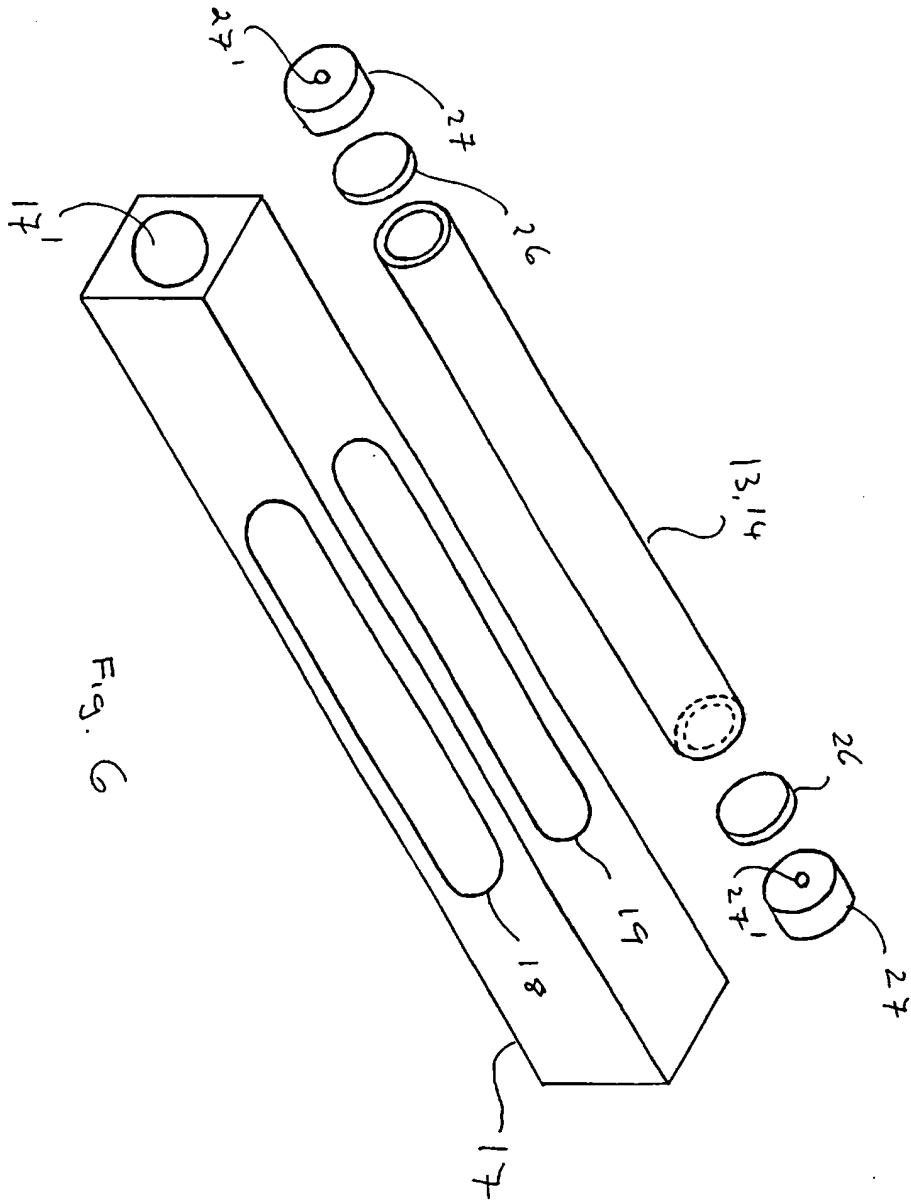


Fig. 5



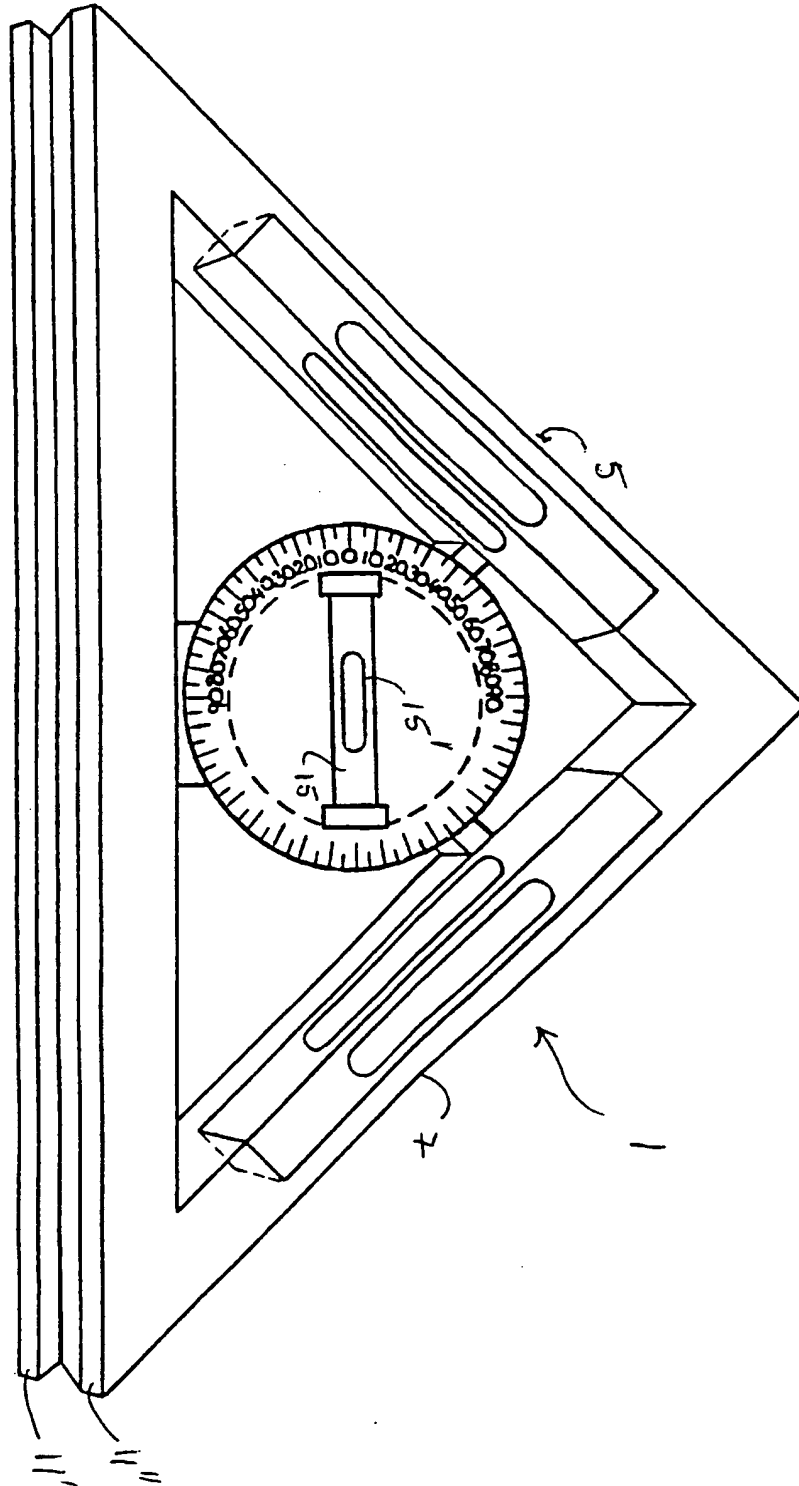


FIG. 7

SPIRIT LEVEL DEVICE

The present invention relates to a spirit level device for indicating or measuring levels.

Spirit levels or leveling tools are known comprising a specially shaped glass tube nearly filled with spirit so as to leave a "bubble" of air and spirit vapour which always rises to the highest part of the tube. The spirit level is used to test whether a surface to which it is applied is horizontal and such spirit level tubes are usually arranged in a support member having a plane parallel with the tube axis which rests on the surface to be measured.

According to the present invention a spirit level device comprises first and second elongate side members disposed at right angles relative to each other and each for resting on a surface whose level is to be measured with the first and second side members each having first and second planar outer side surfaces intersecting at 90° and with the first outer planar side surfaces of the first and second side members intersecting at right angles with each other and the second planar side surfaces of the first and second side members lying in the same plane, and a first and second spirit level tube with spirit and bubble therein being located in or on the first and second said side members respectively and each extending therealong so as to indicate when a first or second side resting on the surface to be measured is level or deviates therefrom.

Preferably each tube is relatively long, for example, with a glass tube of 5" in length and the bubble of 30 mm or so. Preferably each bubble is viewable from at least two sides, namely from a third side extending parallel to and opposite said second side and also from a fourth side of each side member opposite the first sides and subtending the right angle therebetween. This arrangement enables the device to be laid on a surface and the bubble viewed and also for the device to be disposed at 90° to said first mentioned

position and the bubble again also readily viewable because of the resultant double viewing window effect.

Preferably a scale and preferably an angular scale will be provided along each tube and preferably two of such scales are provided along each tube with each one being visible from a 90° window as mentioned above. Preferably the scales will be located so as to be read when viewing through the liquid of the spirit level since magnification of the scale is effected as a result. The scale may be etched or otherwise applied to the surface of the glass tube or alternatively provided on a support member such as a fluorescent/luminescent card located behind and along the length thereof.

Preferably the tubes are each located in a metal carrier insert member itself locatable in a recess in each side member and preferably removable therefrom. Preferably, also the position of the tube and insert member may be adjusted/calibrated as desired by a suitable shims and screw location means. Preferably the insert member is an elongate metal or bar which is preferably machined and has a central bore and two viewing windows at right angles to each other for viewing of the tube and the bar preferably has a central passage running therethrough so that the tube may be located and positioned and, if required, closure bungs on the ends of the tubes may be accessed from either end of the tube for topping up the spirit within the tube via a syringe through the ends of the rubber bungs.

Preferably a third spirit level tube with spirit and bubble will be located in the region of the angle subtended between the two side members and will preferably be rotatably mounted within a circular angularly graduated scale so as to enable the angle of a surface to be indicated/read. Preferably such third spirit level tube will be located in a mounting disposed slightly offset relative to the first and second tubes so as to enable the facing surfaces of said tubes (each preferably provided in a window) to be read i.e. to enable the bubbles to be viewed in the fourth sides of the side members. In such arrangement, the

mounting will have planar surfaces on which the device may be supported and horizontal surface such that the spirit level tubes are also supported on a horizontal plane.

Preferably the device has a third side member joining the ends of the first and second side members to form a 45° right angled triangular i.e. a right angled isosceles triangle, with planar outermost surfaces. Preferably the planar outer surfaces of such a device will have a V groove or channel dividing the planar surface to enable the device to be accurately located on cylindrical support surfaces.

It is also envisaged that a laser device may be incorporated in the device for a level signal indication device or measurement.

Preferably a tripod may be provided with the laser therein.

The spirit level device may be formed of plastics material if it is for the do-it-yourself market although may be formed in metal if as a precision tool.

Also according to the present invention a level indicating/measuring device comprises first, second and third side members or portions forming part of a right angled isosceles triangular frame with two 45° corners and with the outer planar surfaces of the rectangularly arranged first and second side members or portions intersecting each other 90° and with the planar outer surface of the third side member or portion intersecting said first and second planar surfaces of the first and second members at 45° ; and a spirit level tube with spirit and bubble located extending along each of the first and second side members or portions to indicate whether said sides are horizontal, with said first and second side members or portions having planar side surfaces lying in the same plane, and with said spirit levels each being viewable in or from at least two sides of a side member or portion.

Preferably the spirit levels are mounted in carrier members mounted in recesses in each side member. Preferably scales are provided along each of the tubes to indicate horizontal location or variations therefrom. Preferably a third spirit level tube and spirit with bubble is provided rotatably mounted in a mounting therefor which has a circular angular scale provided so that the bubble may be adjusted to give a level reading when the device is supported on a non-level surface such that the angle or gradient of said surface can then be read off from said scales.

Also according to the present invention there is provided a set square or right angled triangular isosceles frame with two 45° angles and having spirit levels disposed at right angles to each other and readable from sides at right angles to each other or readable in either disposition of the set square i.e. horizontal or vertical, and preferably a third rotatably mounted spirit level and scale for enabling the gradient of a surface to be measured. Preferably the levels are engineer's spirit levels which have a long tube and long bubble. The subject matter of claims 1 to 30 is incorporated herein by this reference.

The present invention will be described further, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 is a perspective view from above of a level indicating device according to the invention laid flat on a planar support surface which will normally be horizontal and whose levels are to be measured in two directions at right angles by first and second spirit levels;

Figs 2 and 3 are perspective views of the device of Fig. 1 but raised into an upright position and located in Fig. 2 as if it were to rest on a horizontal tube or in Fig. 3 against a vertical tube for checking the levels thereof;

Fig. 4 is a perspective view of the device of Figs. 2 and 3 but rotated through 90° and illustrated in an upright position with the hypotenuse side about to rest on a tube whose gradient is to be measured by a third rotatable spirit level tube;

Fig. 5 is a perspective view of the device in a disposition similar to Fig. 2 but with the tube whose level is to be found being inclined and the third spirit level rotated to indicate the level;

Fig. 6 is an exploded view of a spirit level tube and closures above a housing therefor locatable in the sides of the frame of the device of Figs. 1 to 5; and

Fig. 7 is a view of the device of Fig. 1, with the hypotenuse resting on a horizontal surface such that the sides thereabove provide a precise 45° angle guide to items placed thereagainst.

A device 1 for indicating or checking levels or gradients is shown in the drawings and includes a triangular, precision set square or frame which comprises a triangular frame which has a first side member 2 of generally rectangular cross section and a second side member 3 of generally rectangular cross section arranged at right angles to each other. The first and second members 2,3 each have first and second outer planar surfaces 4,5 and 6,7 respectively thereof intersecting at 90° and the outermost planar surfaces 5 and 7 intersect at right angles, i.e. at 90° and may rest on a surface to be measured. The surfaces 5,7 are each provided with a central - elongate V-sectioned groove 8,9 running therealong to enable the device to be located on cylindrical surfaces such as a tube 10 or 10' in Fig. 2 or 3 respectively. A third side member 11 forming the of the right angled isosceles triangular frame 1 is also provided generally of rectangular cross section and has a V-sectioned groove 12 as a continuation of said V-sectioned grooves 8,9 extending therealong to enable the device to be located on a cylindrical support surface such as a tube 10" in Fig. 4. The outer surface of said third side member 11 has planar surfaces 11',11" extending either side of the groove 12 and said planar surface 11',11" intersects the planar surfaces 5,7 of the other two mentioned sides 2,3 at 45° .

Two spirit level tube devices 13,14 are provided in side members 2,3 precisely at 90° to each other and parallel to the planes of sides 5,7 and a

third tube device 15 in side member 11 and since such are generally identical apart from their location.

Each spirit level tube device 13,14 is located in a generally rectangular, cut-out or recess 16 in each side member 2,3 and is carried in a elongate metal carrier member 17 shown in detail in Fig. 6 which is preferably of brass which is machined to have a central bore 17' in which the glass tube 13,14 is located and which tube has rubber bungs 26 as seals with metal retaining caps 27 at its opposite ends to retain the spirit liquid therein and also has a bubble 13',14' and is of generally known construction insofar as it indicates when the tube is level at least when the side member in which it is located is supported on a level surface. It is to be observed that the bubbles 13,14 in the sides which are shown vertically disposed in the drawings are out of curved position and would not normally be so visible. A graduated scale (not shown) is located along each tube 13,14 and may be provided on the tube itself and etched thereinto or otherwise applied or, alternatively may be provided on a carrier member extending along the tube and preferably therebehind and preferably the scale will be backed by or on a fluorescent or luminescent surface to enhance the viewing thereof. The scale is located preferably so as to be viewed through the liquid with the spirit level 13,14 which will act to magnify such scale and make reading more easy. Each carrier device 17 has elongate windows 18,19 disposed in surfaces thereof which are at right angles to each other and thus enable the bubbles 13',14' to be viewed from two sides i.e. through windows 18 or 19 dependent on whether the device 1 is in vertical planes as shown in the drawings or on a horizontal plane, for example, resting on surfaces 4,6.

Whilst filled glass sealed tubes 13,14 may be provided, as an alternative illustrated in Fig. 6, two rubber or other material bungs 26 may be provided sealingly insertable in glass tube 13,14 and held in position by end retainers or caps 27 which may be secured e.g. by press-fit or bonding to the glass. Each cap 27 has a central aperture 27' through which the needle of a

syringe (not shown) may be inserted to penetrate the bungs 26 for topping up liquid in the tube.

The metal carrier members 17 may be secured in position by screws (not shown) (which may extend part way into caps 27) and level adjustment by way of shims may be provided. If a glass spirit level tube should be broken, then such can be readily replaced.

A third spirit level tube 15 is provided in a rotatable member 20 rotatably mounted within a support 21,21' and member 20 has a circular angular scale 22 therearound (preferably of large scales e.g. 4" diameter with individual graduations for accuracy) with angular indications from 0 to 90° and said support 20 is mounted in side support portions 21,21' and offset relative to the inside surfaces of the frames 2,3 so that the windows 19 and the bubbles 13',14' are not obscured by the third tube device 15. The support portion 21 closes in the lower part of corner of the right angle of the frame so as to provide extra rigidity and has the furthestmost surfaces of portions 21,22 as viewed planar so as to enable such and the whole device to be laid on a flat horizontal surface as in Fig. 1 and such that the levels 13,14 would indicate horizontal also. Reading lines 24,25 are provided parallel to planar side surfaces 5,7 to enable the angle of scale 20 to be read when the bubble 15' is horizontal when reading as in Fig. 5. The third tube 15 and scale 22 are provided to enable the angle of gradients to be measured at line 24 or 25.

In Fig. 2 there is illustrated the possibility of checking the level of tube 10 by reading bubble 13' of tube 13 – if central then, tube 10 is level or, if not, the scale associated with tube 13 may be read to ascertain the deviation/inclination.

In Fig. 3, the device is against vertical tube 10' and the bubble 13' read similarly.

Whilst side 5 in Figs. 1, 2 and 5 is laid against the tube, it is alternatively possible for side 7 to be laid thereagainst for alternatively handed users.

In Fig. 5 the device 1 is illustrated located on an inclined tube 10" and the tube 15 is rotated until the bubble 15' is central whereupon the angle at line 24 is read to determine the inclination of tube 10"

The frame device 1 may have sides of approximately 12" length and the glass tubes 13,14,15 may be some 5" long with bubbles 13',14',15' of perhaps 30 mm. The spaces defined within the frame may be advantageous such as to enable fingers of a hand to be placed therearound and gripped to facilitate manipulation of the device by both left- and right-handed users.

The device can be used to either indicate the level or gradient of a surface or to enable a surface to be arranged to be horizontal or for the gradient and level of a surface to be found.

The right angle defining sides will normally be of a sufficient length e.g. in the region of at least 30 cm to give an accuracy over a long surface. Further, the even larger hypotenuse side gives an even longer side for increased accuracy.

A laser beam projection device may be located to project the light as an extension of one plane of one side of the frame.

Measuring scales (not shown) may be provided along sides 2 and/or 3.

The provision of accurately pre-set tubes 13,14 in an accurate set square of a sufficiently large size, provides great accuracy possibilities.

CLAIMS

1. A spirit level device comprising a support means having a first planar surface for resting on a planar supporting surface whose level is to be checked and with said first planar surface having two adjacent sides of equal or substantially equal length extending at right angles to each other, and with two spirit level tubes being disposed with their main axes or operative planes at right angles to each other, with the length of the adjacent sides being such as to extend for sufficient distance along a surface to provide for an accurate measurement of a supporting surface.
2. A device as claimed in claim 1, in which the surfaces defining said two adjacent sides are planar and extend at right angles to each other, and said two spirit levels are also parallel to said two adjacent sides.
3. A device as claimed in claim 1 or 2, in which a third spirit level is rotatably mounted on said support means and associated with a degree scale to enable a horizontal level or deviation therefrom to be read.
4. A device as claimed in any of claims 1 to 3, in which the support is a triangular frame.
5. A spirit level comprising first and second elongate side members disposed at right angles relative to each other and each for resting on a surface whose level is to be measured with the first and second side members each having first and second planar outer side surfaces intersecting at 90° and with the first outer planar side surfaces of the first and second side members intersecting at right angles with each other and the second planar side surfaces of the first and second side members lying in the same plane, and a first and second spirit level tube with spirit and bubble therein being located in or on the first and second said side members respectively and each

extending therealong so as to indicate when a first or second side resting on the surface to be measured is level or deviates therefrom.

6. A device as claimed in claim 5, in which each tube is relatively long, for example, with a glass tube of 5 inches in length and a bubble of 30 mm.

7. A device as claimed in any of claims 1 to 6, in which each bubble of the two spirit levels is viewable from at least two sides, preferably from a third side extending parallel to and opposite said second side and also from a fourth side of each side member opposite the first sides and subtending the right angle therebetween.

8. A device as claimed in any of claims 1 to 7, in which a scale and preferably a scale representing horizontal and degree deviations from horizontal is provided along each tube.

9. A device as claimed in claim 8, in which two of said scales are provided along each tube with each one being visible through 90° windows.

10. A device as claimed in claims 8 or 9, in which the scales are located so as to be read when viewing through the liquid of the spirit level such that magnification of the scale occurs.

11. A device as claimed in any of claims 8 to 10, in which the scale is etched or otherwise applied to the surface of the glass tube and preferably the normally undersurface.

12. A device as claimed in any of claims 8 to 10, in which the scale is provided on a support member located behind or under the glass tube and along the length thereof.

13. A device as claimed in claim 12, in which the support member is a fluorescent or luminescent card or other backing.

14. A device as claimed in any of claims 1 to 13, in which the tubes are each located in a carrier insert member itself located in a recess in each side member.

15. A device as claimed in claim 14, in which each insert member is removable and also the position of the tube and insert member may be adjusted/calibrated as desired by suitable means.

16. A device as claimed in claim 14 or 15, in which the insert member is an elongate metal rod or bar which has a central bore and two viewing windows at right angles to each other for viewing of the tube.

17. A device as claimed in claim 16, in which the bar has a central passage running therethrough so that the glass tube may be located and positioned.

18. A device as claimed in any of claims 1 to 17, in which closure bungs are provided on the ends of the tubes and may be accessed from either end of the tube for topping up the spirit within the tube via a syringe through the ends of the rubber bungs.

19. A device as claimed in claims 1, 2 or 4 or any of claims 5 to 18, in which a third spirit level tube with spirit and bubble is located in the region of the angle subtended between the two side members and is rotatably mounted within a circular degree graduated scale so as to enable the inclination of a surface to be indicated/read.

20. A device as claimed in claim 19, in which such third spirit level tube is located in a mounting disposed slightly offset relative to the first and second tubes so as to enable the facing surfaces of said tubes (each preferably

provided in a window) to be read so as to enable the bubbles to be viewed in the fourth sides of the side members.

21. A device as claimed in claim 20, in which the mounting has planar surfaces which also act to support the device on a horizontal surface such that the spirit level tubes are also supported in a horizontal plane.

22. A device as claimed in any of claims 1 to 21, in which the device has a third side member joining the ends of the first and second side members to form a 45° right angled triangular i.e. a right angled isosceles triangle, with planar outermost surfaces.

23. A device as claimed in any of claims 1 to 22, in which planar outer surfaces of the device have a V-groove or channel dividing the planar surface to enable the device to be accurately located on cylindrical support surfaces.

24. A device as claimed in any of claims 1 to 23, in which a laser device may be incorporated in the device for a level signal indication device or measurement.

25. A level indicating/measuring device comprising first, second and third side members or portions forming part of a right angled isosceles triangular frame with two 45° corners and with the outer planar surfaces of the rectangularly arranged first and second side members or portions intersecting each other 90° and with the planar outer surface of the third side member or portion intersecting said first and second planar surfaces of the first and second members at 45°; and a spirit level tube with spirit and bubble located extending along each of the first and second side members or portions to indicate whether said sides are horizontal, with said first and second side members or portions having planar side surfaces lying in the same plane, and with said spirit levels each being viewable in or from at least two sides of a side member or portion.

26. A device as claimed in claim 25, in which the spirit levels are mounted in carrier members mounted in recesses in each side member.

27. A device as claimed in claims 25 or 26, in which scales are provided along each of the tubes to indicate horizontal location or variations therefrom.

28. A device as claimed in any of claims 25 to 26, in which a third spirit level tube and spirit with bubble is provided rotatably mounted in a mounting therefor which has a circular degree scale provided so that the bubble may be adjusted to give a level reading when the device is supported on a non-level surface such that the angle or gradient of said surface can then be read off from said scales.

29. A set square or right angled triangular isosceles frame with two 45° angles and having spirit levels disposed at right angles to each other and readable from sides at right angles to each other or readable in either disposition of the set square i.e. horizontal or vertical, and preferably a third rotatably mounted spirit level and scale for enabling the gradient of a surface to be measured.

30. A spirit level device substantially as herein described with reference to the accompanying drawings.

Amendments to the claims have been filed as follows

1. A spirit level device comprising a body having first, second and third elongate side members defining sides of a right angled isosceles triangular frame, said first and second elongate side members being of equal length and arranged at 90° to each other, each of said first, second and third side members being of generally rectangular cross section and each having a respective planar outer surface, first and second planar side surfaces and an inner surface, the planar outer surfaces of the first and second side members intersecting each other at 90°, the first side surfaces of the first, second and third side members lying in the same plane to allow the spirit level device to rest on a flat surface on said first side surfaces;

a first and second spirit level tube with spirit and bubble therein being located in or on the first and second elongate side members respectively, each of said first and second spirit level tubes being viewable from the inner surface of the respective side member and from at least the second planar side surface of the respective side member;

a third spirit level tube with spirit and bubble therein being mounted within the space defined by the first, second and third side members for rotation about an axis perpendicular to the longitudinal axis of the tube, a graduated scale being associated with the third spirit level tube, to enable, in use, the inclination of any of the first, second and third side members, and hence the inclination of a surface upon which the respective side member rests, to be determined, the first and second spirit level tubes further indicating when a flat surface upon which the device is laid on its first side surfaces is level or deviates therefrom and indicating when a first or second side member resting on the surface to be measured on its respective outer surface is level or deviates therefrom.



2. A device as claimed in claim 1, in which the third spirit level tube is located in a mounting disposed slightly offset relative to the first and second tubes so as to enable the facing surfaces of said tubes to be read so as to

enable the bubbles to be viewed from the inner surfaces of the first and second side members.

3. A device as claimed in claim 2, in which the mounting has planar surfaces which also act to support the device on a horizontal surface such that the spirit level tubes are also supported in a horizontal plane.

4. A device as claimed in any of claims 1 to 3, in which each bubble of the first and second spirit levels is also viewable from the first side surfaces of the first and second side members respectively.

5. A device as claimed in any of claims 1 to 4, in which a scale and preferably a scale representing horizontal and degree deviations from horizontal is provided along at least one of the spirit level tubes.

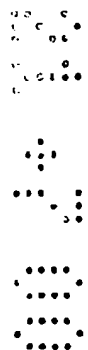
6. A device as claimed in claim 5, in which two of said scales are provided along each tube with each one being visible through 90° windows.

7. A device as claimed in claims 5 or 6, in which the scales are located so as to be read when viewing through the liquid of the spirit level such that magnification of the scale occurs.

8. A device as claimed in any of claims 5 to 7, in which the scale is etched or otherwise applied to the surface of the glass tube and preferably the undersurface.

9. A device as claimed in any of claims 5 to 8, in which the scale is provided on a support member located behind or under the glass tube and along the length thereof.

10. A device as claimed in claim 9, in which the support member is a fluorescent or luminescent card or other backing.



11. A device as claimed in any of claims 1 to 10, in which the first and second tubes are each located in a carrier insert member itself located in a recess in each side member.

12. A device as claimed in claim 11, in which each insert member is removable and also the position of the tube and insert member may be adjusted/calibrated as desired by suitable means.

13. A device as claimed in claim 11 or 12, in which the insert member is an elongate metal rod or bar which has a central bore and at least two viewing windows at right angles to each other for viewing of the tube.

14. A device as claimed in claim 13, in which the bar has a central passage running therethrough so that the glass tube may be located and positioned.

15. A device as claimed in any of claims 1 to 14, in which closure bungs are provided on the ends of the tubes and may be accessed from either end of the tube for topping up the spirit within the tube via a syringe through the ends of the closure bungs.

16. A device as claimed in claim 1, in which each tube is relatively long, for example, with a glass tube of 127 mm in length and a bubble of 30 mm.

17. A device as claimed in any of claims 1 to 16, in which the planar outer surfaces of the device have a V-groove or channel dividing the planar surface to enable the device to be accurately located on cylindrical support surfaces.

18. A device as claimed in any of claims 1 to 17, in which a laser device may be incorporated in the device for a level signal indication device or measurement.



19. A spirit level device substantially as herein described with reference to the accompanying drawings.





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INVESTOR IN PEOPLE

Application No: GB 0004922.1
 Claims searched: ALL

Examiner: Michael Walker
 Date of search: 22 May 2000

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): G1F; G1X

Int Cl (Ed.7): B43L 7/00, 7/02, 7/027, 13/00; G01C 9/24, 9/26, 9/28

Other: On-line: EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y \	GB 2319084 A (DIBBEN) whole document	24
Y \	GB 2226405 A (MORRIS) see abstract	3,19,28
X,Y \	GB 2196438 A (JONES) eg.p.2,11.32 etc	X:1,2,4,5, 7,14,15,22 25,26,29 Y:23,24
Y \	GB 2157433 A (MORRIS) see figures	3,19,23,28
X \	GB 0511663 (MOIOLA) fig.11; p.3,1.47 etc	1,2,4,5,7,1 4,22,25, 26,29
X,Y \	WO 00/09346 A1 (VERSA) see abstract	X:1,2,5,7, 22,25,29 Y:3,19,23, 28
X \	DE 19530990 A (MOHR) see abstract	1,2,4,5,7,2 2,25,29

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.



Application No: GB 0004922.1
Claims searched: ALL

Examiner: Michael Walker
Date of search: 22 May 2000

Category	Identity of document and relevant passage	Relevant to claims
X,Y	US 5894675 (CERICOLA) whole document	X: 1,4,5,7, 22,24,25, 26,29 Y: 3,19,23, 28

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.